

### SFP-1GB-BX91D-120-SC-C-AO

Cisco® Compatible TAA 1000Base-BX SFP Transceiver (SMF, 1590nmTx/1510nmRx, 120km, SC, DOM)

#### Features

- SFF-8472 and MSA Compliant
- Simplex SC Connector
- Up to 1.25Gbps data links
- CWDM DFB and APD-TIA with 34dB power budget
- Single 3.3V power supply and TTL logic interface
- Single-mode fiber
- Support Hot Pluggable
- Commercial Temperature 0 to 70 Celsius
- RoHS compliant and Lead Free
- Metal with lower EMI



#### Applications

- 1000Base Ethernet

#### Product Description

This Cisco® SFP transceiver provides 1000Base-BX throughput up to 120km over single-mode fiber (SMF) using a wavelength of 1590nmTx/1510nmRx via a SC connector. It is guaranteed to be 100% compatible with the equivalent Cisco® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

AddOn's transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



## Absolute Maximum Ratings

| Parameter                   |     | Symbol           | Min. | Typ.  | Max. | Unit |
|-----------------------------|-----|------------------|------|-------|------|------|
| Power Supply Voltage        |     | V <sub>cc</sub>  | 3.15 | 3.3   | 3.45 | V    |
| Storage Temperature         |     | T <sub>stg</sub> | -40  |       | 85   | °C   |
| Operating Case Temperature  |     | T <sub>c</sub>   | 0    |       | 70   | °C   |
| Operating Relative Humidity |     |                  |      |       | 95   | %    |
| Data Rate                   | FE  |                  |      | 100   |      | Mbps |
|                             | FC  |                  |      | 1.063 |      | Gbps |
|                             | GBE |                  |      | 1.25  |      | Gbps |

## Notes:

- Exceeding any one of these values may destroy the device immediately.

## Electrical Characteristics

| Parameter                     |         | Symbol           | Min. | Typ. | Max.                 | Unit  | Notes |
|-------------------------------|---------|------------------|------|------|----------------------|-------|-------|
| Supply Voltage                |         | V <sub>cc</sub>  | -0.5 |      | 3.6                  | V     |       |
| Power Supply Current          |         | I <sub>cc</sub>  |      |      | 300                  | mA    |       |
| Transmitter                   |         |                  |      |      |                      |       |       |
| LVPECL Differential Inputs    |         | V <sub>IN</sub>  | 400  |      | 2000                 | mVp-p | 1     |
| Input Differential Impedance  |         | Z <sub>IN</sub>  | 85   | 100  | 115                  | Ω     | 2     |
| Tx_Disable                    | Disable |                  | 2    |      | V <sub>cc</sub>      | V     |       |
|                               | Enable  |                  | 0    |      | 0.8                  | V     |       |
| Tx_Fault                      | Fault   |                  | 2    |      | V <sub>cc</sub> +0.3 | V     |       |
|                               | Normal  |                  | 0    |      | 0.5                  | V     |       |
| Receiver                      |         |                  |      |      |                      |       |       |
| LVPECL Differential Outputs   |         | V <sub>OUT</sub> | 370  |      | 2000                 | mVp-p | 3     |
| Output Differential Impedance |         | Z <sub>OUT</sub> | 85   | 100  | 115                  | Ω     |       |
| Rx_LOS                        | LOS     |                  | 2    |      | V <sub>cc</sub> +0.3 | V     |       |
|                               | Normal  |                  | 0    |      | 0.8                  | V     |       |
| MOD_DEF(0:2)                  |         | V <sub>OH</sub>  | 2.5  |      |                      | V     | 4     |
|                               |         | V <sub>OL</sub>  | 0    |      | 0.5                  | V     | 4     |

## Notes:

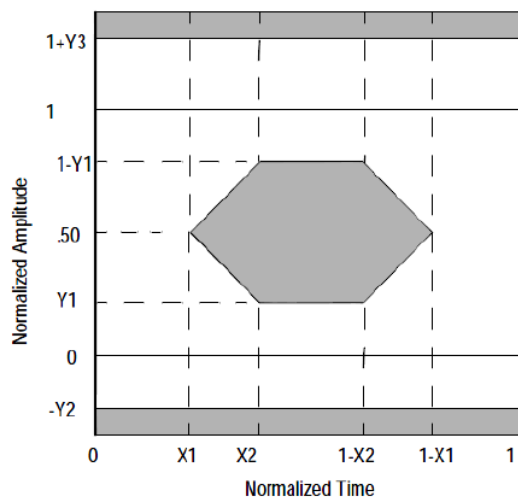
- LVPECL logic. Internally AC coupled inputs.
- R<sub>IN</sub>>100kΩ @DC.
- LVPECL logic. Internally AC coupled outputs.
- With serial ID.

## Optical Characteristics

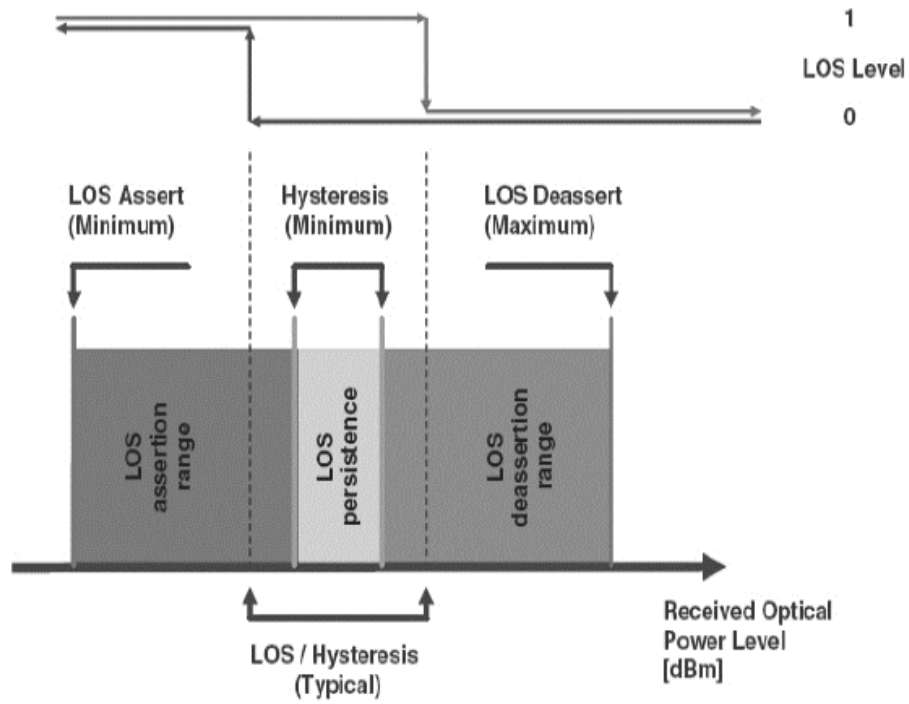
| Parameter                   | Symbol          | Min.                             | Typ. | Max.   | Unit | Notes |
|-----------------------------|-----------------|----------------------------------|------|--------|------|-------|
| Power Budget                |                 | 34                               |      |        | dB   |       |
| Data Rate                   |                 | 100                              |      | 1250   | Mbps |       |
| <b>Transmitter</b>          |                 |                                  |      |        |      |       |
| Channel Center Wavelength   |                 | 1584                             | 1590 | 1597.5 | nm   | 1     |
| Spectral Width (-20dB)      | $\Delta\lambda$ |                                  |      | 1      | nm   |       |
| Side-Mode Suppression Ratio | SMSR            | 30                               |      |        | dB   |       |
| Average Output Power        | POUT            | 1                                |      | 5      | dBm  | 2     |
| Extinction Ratio            | ER              | 9                                |      |        | dB   | 3     |
| Rise/Fall Time (20-80%)     | Tr/Tf           |                                  |      | 2      | ns   |       |
| Output Optical Eye          |                 | Compliant with IEEE 802.3ah-2004 |      |        |      | 3, 4  |
| Tx_Disable Assert Time      | T_off           |                                  |      | 10     | us   |       |
| <b>Receiver</b>             |                 |                                  |      |        |      |       |
| Channel Center Wavelength   |                 | 1490                             | 1510 | 1530   | nm   | 1     |
| Receiver Sensitivity        | Pmin            |                                  |      | -33    | dBm  | 5     |
| Receiver Overload           | Pmax            | -8                               |      |        | dBm  |       |
| Return Loss                 |                 | 12                               |      |        | dB   |       |
| Optical Path Penalty        |                 |                                  |      | 1      | dB   |       |
| LOS De-Assert               | LOSD            |                                  |      | -34    | dBm  |       |
| LOS Assert                  | LOSA            | -45                              |      |        | dBm  |       |
| LOS Hysteresis              |                 | 0.5                              |      |        | dB   | 6     |

### Notes:

1. The channel center wavelength of the transmitter and receiver sides are typical wavelengths of CWDM channels  $\pm 20\text{nm}$ .
2. Output is coupled into a 9/125 $\mu\text{m}$  single-mode fiber.
3. Filtered. Measured with a PRBS  $2^7-1$  test pattern @1250Mbps.
4. Eye pattern mask:



5. Measured at all data rates specified above with  $ER=9\text{dB}$ ,  $2^7-1$  PRBS data pattern, and  $BER < 10^{-12}$ .
6. LOS Hysteresis:



## Pin Descriptions

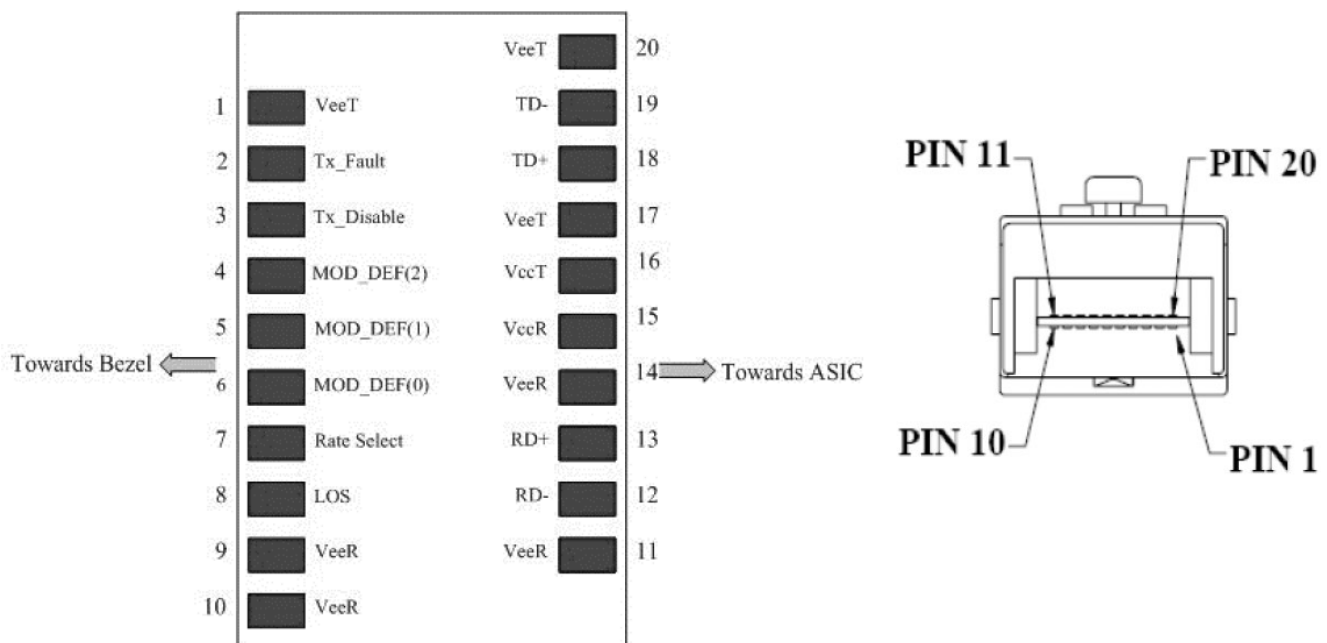
| Pin | Symbol      | Name/Description                                          | Plug Sequence | Notes |
|-----|-------------|-----------------------------------------------------------|---------------|-------|
| 1   | VeeT        | Transmitter Ground.                                       | 1             | 5     |
| 2   | Tx_Fault    | Transmitter Fault Indication.                             | 3             | 1     |
| 3   | Tx_Disable  | Transmitter Disable. Module Disables on “High” or “Open.” | 3             | 2     |
| 4   | MOD-DEF2    | Module Definition 2. 2-Wire Serial Interface Data.        | 3             | 3     |
| 5   | MOD-DEF1    | Module Definition 1. 2-Wire Serial Interface Clock.       | 3             | 3     |
| 6   | MOD-DEF0    | Module Definition 0. Grounded Within the Module.          | 3             | 3     |
| 7   | Rate Select | Not Connected.                                            | 3             | 9     |
| 8   | LOS         | Loss of Signal.                                           | 3             | 4     |
| 9   | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 10  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 11  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 12  | RD-         | Inverted Received Data Out.                               | 3             | 6     |
| 13  | RD+         | Received Data Out.                                        | 3             | 7     |
| 14  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 15  | VccR        | Receiver Power. 3.3±5%.                                   | 2             | 7     |
| 16  | VccT        | Transmitter Power. 3.3±5%.                                | 2             | 7     |
| 17  | VeeT        | Transmitter Ground.                                       | 1             | 5     |
| 18  | TD+         | Transmit Data In.                                         | 3             | 8     |
| 19  | TD-         | Inverted Transmit Data In.                                | 3             | 8     |
| 20  | VeeT        | Transmitter Ground.                                       | 1             | 5     |

### Notes:

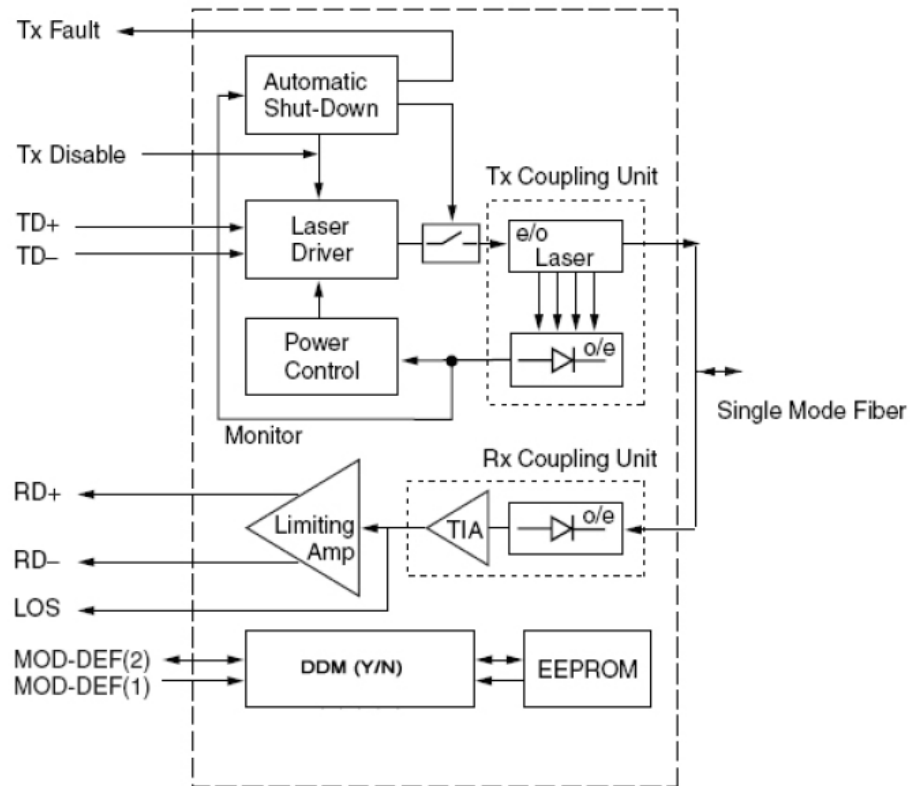
1. Tx\_Fault is an open collector/drain output which should be pulled up with a 4.7kΩ to 10kΩ resistor on the host board. Pull-up voltage is between 2.0V and  $V_{ccT}/R+0.3V$ . When “high,” the output indicates a laser fault of some kind. “Low” indicates normal operation. In the “low” state, the output will be pulled to <0.8V.
2. Tx\_Disable is an input that is used to shut down the transmitter optical output. It is pulled up in the module with a 4.7kΩ to 10kΩ resistor. Its states are:
  - Low (0V-0.8V): Transmitter On
  - (>0.8V, <2.0V): Undefined
  - High (2.0V-3.465V): Transmitter Disabled
  - Open: Transmitter Disabled.
3. MOD-DEF0, 1, and 2. These are the module definition pins. They should be pulled up with a 4.7kΩ to 10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.
  - MOD-DEF0 is grounded by the module to indicate that the module is present.
  - MOD-DEF1 is the clock line of the 2-wire serial interface for serial ID.
  - MOD-DEF2 is the data line of the 2-wire serial interface for serial ID.

4. LOS (Loss of Signal) is an open collector/drain output which should be pulled up with a 4.7k $\Omega$  to 10k $\Omega$  resistor. Pull-up voltage is between 2.0V and VccT/R+0.3V. When “high,” this output indicates that the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). “Low” indicates normal operation. In the “low” state, the output will be pulled to <0.8V.
5. VeeR and VeeT may be internally connected within the SFP module.
6. RD $\pm$ : these are the differential receiver outputs. They are AC coupled 100 $\Omega$  differential lines which should be terminated with 100 $\Omega$  (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370mV and 2000mV differential (185mV to 1000mV single-ended) when properly terminated.
7. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V $\pm$ 5% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 $\Omega$  should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.
8. TD $\pm$ : these are the differential transmitter inputs. They are AC coupled, differential lines with 100 $\Omega$  differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 400mV to 2000mV (250mV to 1200mV single-ended), though it is recommended that values between 500mV and 1200mV differential (250mV to 600mV single-ended) be used for best EMI performance.
9. Function not available.

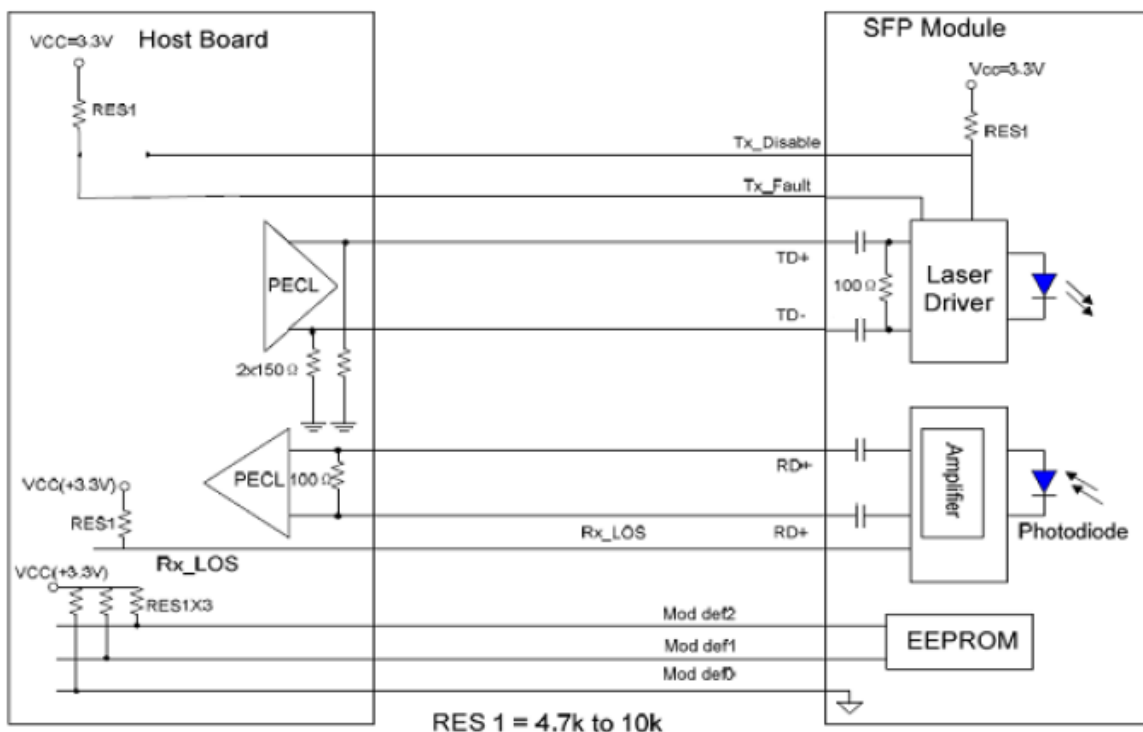
## Electrical Pin-out Details



## Functional Description of the Transceiver



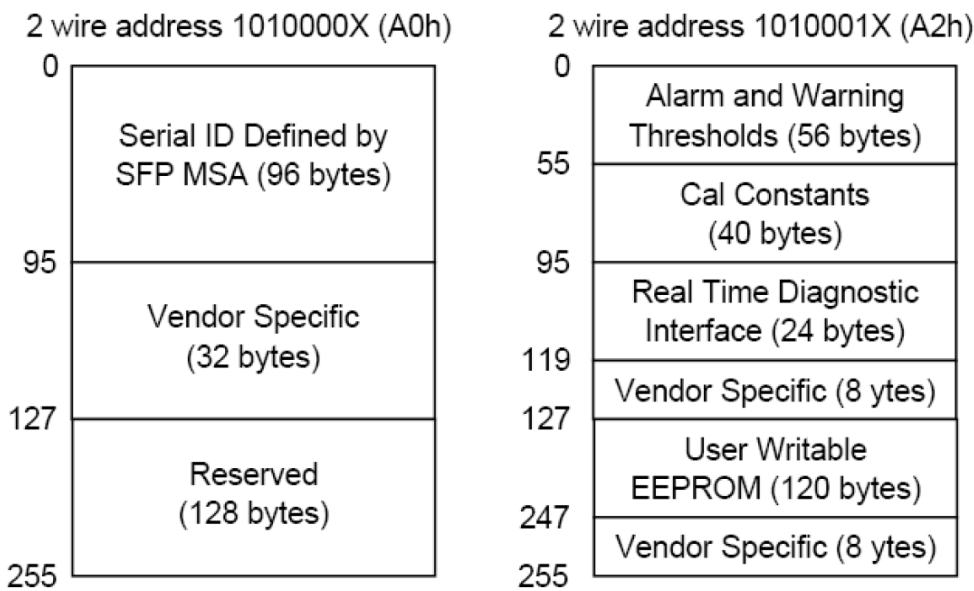
## Recommended Circuit Schematic



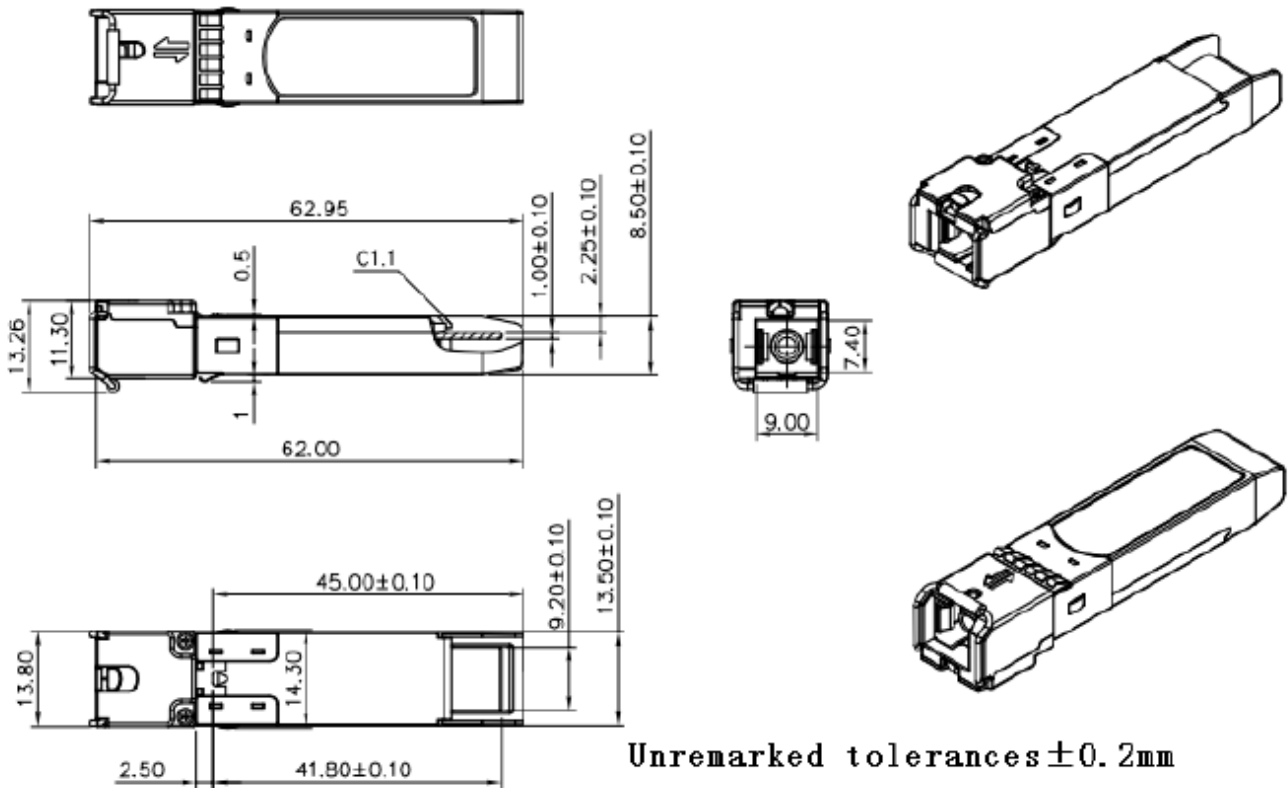
**EEPROM**

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA) is bidirectional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring, and temperature monitoring all are implemented. The diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field define as following. For detailed EEPROM information, please refer to the related document of SFF 8472 Rev 9.3.



Mechanical Specifications



## About AddOn Networks

In 1999, AddOn Networks entered the market with a single product. Our founders fulfilled a severe shortage for compatible, cost-effective optical transceivers that compete at the same performance levels as leading OEM manufacturers. Adhering to the idea of redefining service and product quality not previously had in the fiber optic networking industry, AddOn invested resources in solution design, production, fulfillment, and global support.

Combining one of the most extensive and stringent testing processes in the industry, an exceptional free tech support center, and a consistent roll-out of innovative technologies, AddOn has continually set industry standards of quality and reliability throughout its history.

Reliability is the cornerstone of any optical fiber network and is ingrained in AddOn's DNA. It has played a key role in nurturing the long-term relationships developed over the years with customers. AddOn remains committed to exceeding industry standards with certifications from ranging from NEBS Level 3 to ISO 9001:2005 with every new development while maintaining the signature reliability of its products.



## U.S. Headquarters

Email: [sales@addonnetworks.com](mailto:sales@addonnetworks.com)

Telephone: +1 877.292.1701

Fax: 949.266.9273

## Europe Headquarters

Email: [salesupportemea@addonnetworks.com](mailto:salesupportemea@addonnetworks.com)

Telephone: +44 1285 842070